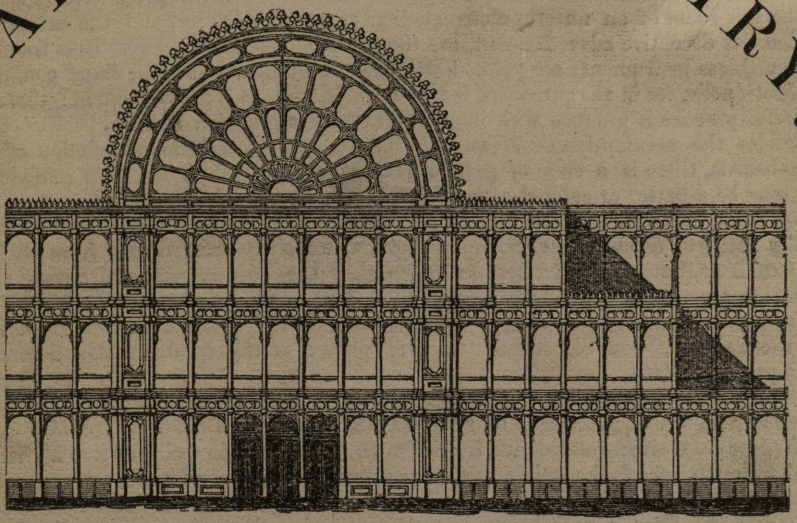
THE EXHIBITION OF 1851.

THE PALACE OF INDUSTRY:



ITS ORIGIN AND PROGRESS.

by

John Ollivier.

ILLUSTRATED WITH NUMEROUS ENGRAVINGS ON WOOD.

R. Ackermann,
191
Regent Street.

JOHN OLLIVIER, 59, PALL MALL.

MDCCCLI.

Price One Shilling.

CAUTION.

COLLARD AND COLLARD'S PIANOFORTES.

Messrs. COLLARD and COLLARD deem it due to the public and to their own reputation to direct attention to a case recently heard before Mr. Alderman HUNTER, at the Guildhall Police-office, in which an Auctioneer was bound over to appear at the Session to answer a charge of obtaining money from a lady under false pretences, by the sale of a pianoforte with their names improperly affixed to it.

The daily increasing prevalence of this offence, and the injury it inflicts alike on the purchaser, and on the credit of the reputed manufacturer, render it expedient that the attention of the public should be more immediately called to the evil, with the view of exposing the fraud, and of counteracting the mischief to which it gives rise.

The sale-room of an unscrupulous auctioneer or upholsterer, and the attractively-worded but deceptive advertisement, are the usual channels by which these fraudulent and worthless instruments are palmed off upon the public; nor is the fraud confined to the Metropolis, for in the provinces it is carried on even to a greater extent: there this shameful practice is pursued with impunity, and too often with success.

Besides the assumption of Messrs. COLLARDS' names, and the simulation of their name-boards, there is a class of petty makers who "plant" pianos, with confederates, who may be a hatter or cabinet-maker, a stationer, or a lodging-housekeeper; the last-named being the best adapted for the purposes of deception. These instruments have usually fictitious names of makers upon them, who are represented as "from COLLARD and COLLARD," and are advertised as by "one of the best makers, and having all the recent improvements."

These matchless bargains are to be sold, sometimes "because its owner is about to quit the country," and sometimes "in consequence of the sudden widowed condition of its possessor."

Another artifice by which the unwary are entrapped, is that adopted by makers of no reputation, whose practice is to advertise and expose a Pianoforte actually manufactured by an eminent maker side by side with their own, in order to give a character to them, but purposely kept in a condition utterly unfit either for the purposes of sale or comparison.

There is, however, a security against these frauds, of easy access to all who contemplate purchases through such suspicious channels—namely, to refer the matter to any one of the respectable music-sellers or professors of music in such localities to substantiate by their opinion the genuineness of such instruments; and in any case where such reference cannot be made, Messrs. Collard and Collard will be ready themselves to furnish the requisite information. By this means the real character of such Pianofortes may be easily ascertained. In all cases, however, they will be happy to render every assistance in their power, whether with the view of preventing fraud or of detecting and punishing it when perpetrated.—26, Cheapside, and 195, Tottenham Court Road, February 7, 1851.

*** THE Editor of the following pages begs to state that it is his intention, as soon as the Palace of Industry is opened to the public, to publish a continuation of this little work, giving an account of the peculiarities of the building which cannot, in its present stage, be described, as well as to record all such matters in connexion with it, as will be found to possess permanent interest. For this purpose he will be happy and thankful to receive any communications from Exhibitors or others having reference to the work, which they may be disposed to favour him with, to the care of the Publisher, 59, Pall Mall.

London. Engd & Publd by C & E. Layton. Fleet Street.

THE BUILDING IN HYDE PARK.

For the Great Exhibition 1851.

Length 1848 ft. Width 408 ft. Height 66 ft. Cost £150,000. Covers 18 Acres.

Designed by Mr. Paxton. Contractors Messrs. Fox & Henderson.

DIEU ET MON DROIT

L'EDIFICE A HYDE PARK.

Pour la Grande Exposition de 1851.

Longueur 1848 pds. Largeur 408 pds. Hauteur 66 pds. Coûte £150,000. Couvre 18 Arpens

Désigné par M. Paxton. Entrepreneurs Mess. Fox & Henderson.

THE EXHIBITION OF 1851.

THE PALACE OF INDUSTRY:

A Brief History

OF

ITS ORIGIN AND PROGRESS;

WITH

A Descriptive Account

OF THE

MOST INTERESTING PORTIONS OF THE MACHINERY

EMPLOYED IN ITS CONSTRUCTION.

ILLUSTRATED WITH NUMEROUS ENGRAVINGS ON WOOD.

London:
JOHN OLLIVIER, 59, PALL MALL.
MDCCCLI.

HHS
22.5.96

TO

HIS ROYAL HIGHNESS

PRINCE ALBERT, K.G.

THE ORIGINATOR OF THE

First Great Industrial Exhibition,

THE

DISTINGUISHED AND ZEALOUS PROMOTER

OF

ART, INDUSTRY AND COMMERCE,

THIS BRIEF

HISTORY OF THE BUILDING

INTENDED TO RECEIVE THE PRODUCTIONS OF ALL NATIONS,

IS MOST RESPECTFULLY

Dedicated.

The Palace of Industry.

We are shortly to see collected together, the choicest specimens of the choicest workmanship, of the most skilled countries of the world. Europe, Asia, Africa, and America, are to vie with each other in a contest of industry; are to enter the lists of a peaceful rivalry, that shall test the talents and sharpen the wits of each, and improve the taste of all. No struggle of arms, no waste of energy or wealth in a contest of mutual animosity and destruction, but a gathering up of all that is admirable and elegant, and costly and useful, into one huge glass cornucopœia, that shall in its very fulness give testimony at once to the wealth, the industry, the genius, and the taste of the modern civilized world.

It would be foreign to our purpose in the following pages to enter into any description of the means adopted by the Royal Commissioners for the purpose of accomplishing this great object. Neither need we do more than allude to the apathy which for a long time existed amongst the people of England; it was, perhaps, the effect rather of ignorance of the nature and objects of the Exhibition, than of a feeling of indifference. Happily, that ignorance and hostility everywhere disappeared upon the representations of the gentlemen who were officially deputed by the Royal Commissioners to lay bare the social advantages which were to ensue from it. "The accomplished fact" is sufficient to shew that this advocacy was successful, that selfish opposition was speedily changed into popular enthusiasm. One of the first considerations entered into by the Royal Commissioners on their appointment, was to come to some decision as to the best means of raising a proper recep-

tacle for the contributions which they were about to invite from the four quarters of the globe. Accordingly, one of their early decisions produced the following document:—

"The Committee appointed by the Royal Commission to advise on 'all matters relating to the building,' having received the sanction of the Commission, are desirous of obtaining from all parties, who are disposed to assist them, suggestions for the general arrangement of the buildings and premises required for this exhibition. Upon the general form of the building in plan, the distribution of its parts, the mode of access, and the internal arrangements and contrivances will depend the convenience and general fitness of such a building; and it is upon these points that the Committee seek information and suggestions, and wish to encourage the most extended competition in the preparation of plans. The Committee do not propose to offer any pecuniary reward for such plans—they rely upon the desire which men of all countries will feel to forward the objects of the proposed exhibition. The Committee think it probable, that when the plans are received, they may not be limited to the selection of any one plan, but may derive useful ideas from many; and that the best plan may be determined upon by the help of this general assistance. As the credit of any such plan will be due solely to the contributors, the Committee propose to make a report, in which they will acknowledge by name, those whose plans had been wholly or partially adopted, or who had afforded the most useful suggestions: and the Committee hope to be able to offer such other honorary distinction to the successful contributors as the circumstances may appear to warrant. In order to guide the contributors in the preparation of such plans and designs, and to facilitate the examination and the comparison of them when received, the Committee have enumerated concisely the principal 'desiderata' for such a building, and have laid down certain rules and conditions, to which they earnestly request the contributors to conform, as the Committee will be under the necessity of abiding strictly by the regulation of not acknowledging any plans which may be sent in a form inconsistent with these rules."

The surprising number of two hundred and forty-five competitors entered

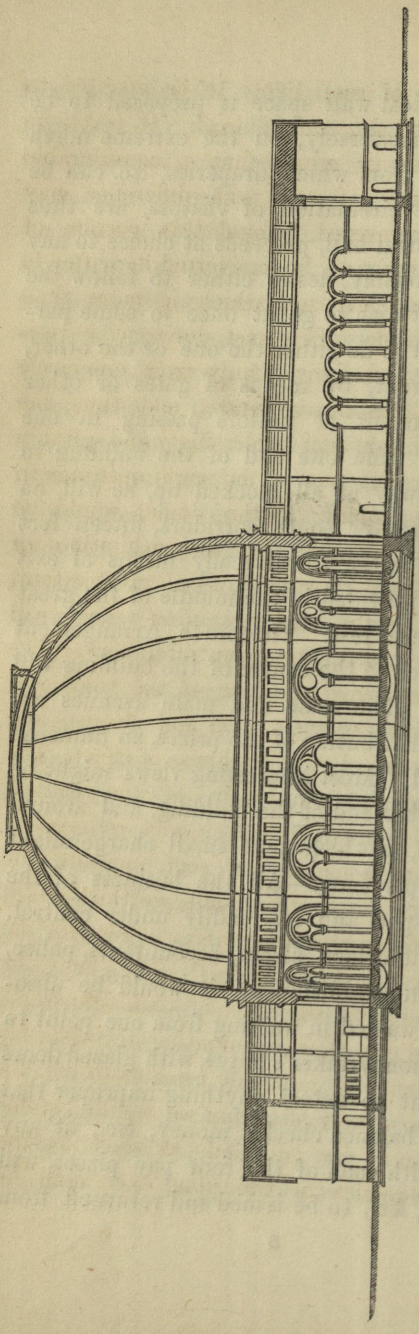
the lists upon this occasion. Of these 27 were Frenchmen, 2 Belgians, 3 Dutch, 1 Hanoverian, 1 Neapolitan, 2 Swiss, 1 Rhenish Prussian, and 1 from Hamburg. Although plans were produced in every architectural variety, not one of them fulfilled all the conditions prescribed by the nature of the undertaking. The Building Committee, having minutely discussed the excellencies and defects of the designs submitted to them, determined on preparing a design of their own; availing themselves, as we have seen they intended to do, of the suggestions which the several plans afforded them. The distinctive feature of this highly favoured plan was its colossal dome. On the 9th of May they agreed upon the following report, signed W. Cubitt, their Chairman, which they presented to the Royal Commission.

"We have the honour to report that we have examined the numerous plans so liberally contributed by native and foreign architects, in accordance with the public invitation. Exhausting in their numerous projects and suggestions almost every conceivable variety of building, the authors of those designs have materially assisted us in arriving at the conclusions which we have now the honour to report. We have been aided in our analysis of this subject by a great amount of thought and elaboration thus brought to bear upon it from various points of view. We have, however, arrived at the unanimous conclusion, that able and admirable as many of these designs appeared to be, there was yet no single one so accordant with the peculiar objects in view, either in the principal or detail of its arrangement, as to warrant us in recommending it for adoption. In some of the least successful of the designs submitted, we find indicated errors and difficulties to be avoided, whilst in the abler and more practical of them, there are valuable conceptions and suggestions, which have greatly assisted us in framing the plan we have now the honour to lay before you. In preparing this design, we have been governed mainly by three considerations:—1. The provisional nature of the building. 2. The advisability of constructing it as far as possible in such a form as to be available, with least sacrifice of labour and material, for other purposes, so soon as its original one shall have been fulfilled; thus ensuring a minimum ultimate cost. 3. Extreme simplicity demanded by the short

time in which the work must be completed. For the arrangements of the plan, we rely for effect on honesty of construction, vastness of dimension, and fitness of each part to its end. The principal points of excellence we have endeavoured to attain, are—1. Economy of construction. 2. Facilities for the reception, classification, and display of goods. 3. Facilities for the circulation of visitors. 4. Arrangements for grand points of view. 5. Centralisation of supervision. 6. Some striking feature to exemplify the present state of the science of construction in this country. The first of these, Economy, is attained by doing away with any internal walls (all divisions being made by the necessary stalls), by reducing the whole construction, with the exception of the dome, to cast iron columns, supporting the lightest form of iron roof in long unbroken lines, and by the whole of the work being done in the simplest manner, and adapted in all respects to serve hereafter for other purposes. The second, Facilities for the reception, classification, and display of goods. The main central entrance for the reception of objects for exhibition will, probably, be that most approachable from the public road. All cases accompanying goods will be examined, registered, catalogued, &c., in the offices of the executive; the packing-cases will then be put upon a truck, running on a line of rails, laid down temporarily, and conveyed to the centre turn-table, from which they may be carried by a line of rails at right angles to the first, to the end of the transverse gallery, in which they may be destined to be placed. The most important condition to ensure successful classification, is, that those to whom the duty of arrangement may be confided, should be hampered by no fixed limits of space, such as would have been the case had the building been divided into a number of halls, sections, or chambers. The plan submitted fulfils this condition perfectly; as objects can be arranged just as they are received, and moved, if necessary, from gallery to gallery with great facility.

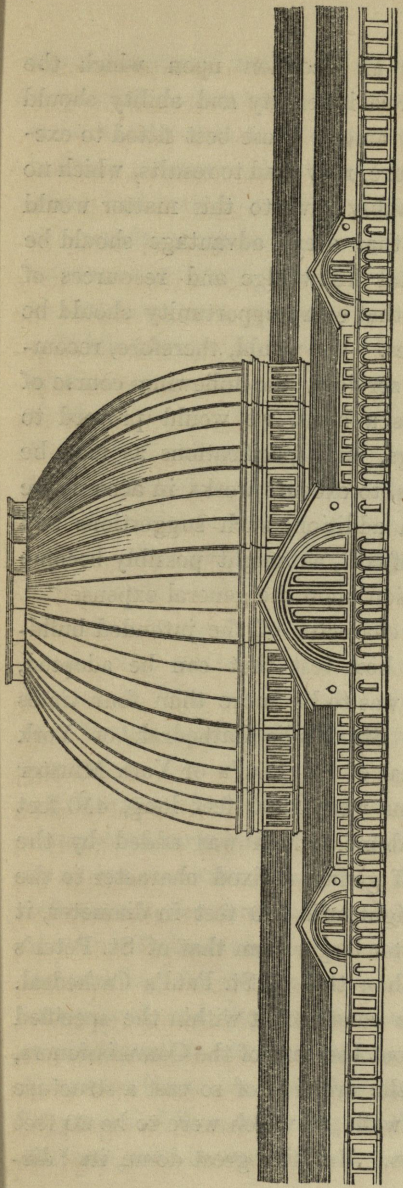
"The successful display of the goods would be best insured by leaving, under certain general restrictions, the fitting up of each stall to the exhibitor, or his agent, floor space only being allotted to each; and stands, frames, brackets, &c., being put up by a contractor's carpenter, at a fixed tariff. The

best light is provided, and the most economical wall space is proposed to be furnished by connecting pillar to pillar transversely, on the extreme north and south sides of the building, by rods, from which draperies, &c. can be suspended. The third, Facilities for the circulation of visitors, are thus attained. The visitor, on arrival at the central hall, proceeds at choice to any one of the four sections. He will, most probably, desire either to follow the whole course of the section selected, or will wish to go at once to some particular class or object. He will be enabled to do either the one or the other, without interfering with the general current, by means of gates or other arrangements, which shall ensure the current of visitors passing in one direction. If he desire to proceed rapidly from one end of the building to the other, and finds the great central gangway at all blocked up, he will, no doubt, be able to get on by either the north or south corridors, fifteen feet wide. Numerous doors of egress in these latter, afford ready means of exit for a large number of persons. Seats are provided in the middle of the great central gangway, for those who may desire to rest. The fourth, Arrangement for grand points of view.—The view from or to the centre of the building will from its extent be necessarily imposing. The seats and main avenues are arranged, so that on the occasion of the distribution of the prizes, an immense number of persons may be accommodated. Most interesting views might be obtained from galleries, constructed at either end of the building, and around the dome, for the admission of the public, to which some small charge might be made. The fifth, Centralization of supervision.—All the business of the exhibition would be carried on in one spot, and be readily under control. The Royal Commission, the principal Committees, clerks, accountants, police, &c., would be together, and in so large an establishment, it would be absolutely necessary, or much time would be wasted in walking from one point to another. Passages running behind the money-taker's boxes, with glazed doors into them, would enable each accountant to detect anything improper that might be going on, and to exchange and balance checks, money, &c., at any moment. Telegraphic communication with each of the four pay places, will permit orders to be given, cash accounts, &c., to be issued and returned, from



Section of the intended Building.

and to the head accountant's office, as often as may be necessary. Four committee rooms, one for a jury in each section, have been provided at the extreme east and west ends. The duties of such committees being deliberative, and not executive, it is not necessary that they should be accommodated in the central establishment, where they would be more liable to be disturbed than at the extremity of the building. A policeman stationed in each gallery would, from his elevated position, be enabled to observe much which might escape detection if he mingled only with the crowd. The sixth, Some striking feature to exemplify the present state of the science of construction in this country. In order that the building, in which England invites the whole world to display their richest productions, may afford, at least in one point, a grandeur not incommensurate with the occasion, we propose by a dome of light sheet iron, 200 feet in diameter, to produce an effect at once striking and admirable. From calculations which have been made of the cost of so grand a hall, we have reason to expect that it may be executed for a sum not exceeding the cost of the simplest



Elevation of the intended Building.

form of roof, likely to be adopted to cover the same area. It is to be borne in mind, that a considerable amount of any such difference may be recovered, should this portion of the building be converted hereafter to other purposes, which is more than probable. This vast dome, it is proposed, to light mainly from one circle of light in its centre, and thus the sculpture will be pleasingly and suitably lit. Six out of the eight openings in the cylinder of the dome, would be well adapted for the exhibition of stained glass windows of great extent, while the two remaining arches will open to the main central gallery. The lower part of some of the voids will admit the eye to turf and shrubs, and produce a great freshness of effect. The immense continuity of the central avenue will be broken, and relieved by a variation in the roof, opposite the openings to the second and third sets of refreshment rooms and windows, for the reception of stained glass, may be placed at the ends of each transverse gallery, thus terminating the vista for each. It now only remains to explain the course of action we would recommend for adoption, as soon as the principles of the plan, &c. shall be

positively decided. We consider this to be an occasion upon which the greatest amount of intellectual and commercial ingenuity and ability should be called out; and that a generous rivalry among those best fitted to execute the principal portions of this vast structure, may lead to results, which no amount of detailed study, that we could possibly give to this matter would supply. We would, therefore, recommend that every advantage should be taken of the accumulated and experimental knowledge and resources of intelligent and enterprising contractors, and that every opportunity should be afforded to them of distinguishing themselves. We would, therefore, recommend as the best means of enlisting their services, the following course of action: — Adopting the approved design as a basis, we would proceed to immediately prepare such working drawings, and specifications as may be necessary, and to issue invitations for tenders, to execute works in accordance with them, requesting from competitors in addition, such suggestions and modifications, accompanied with estimates of cost, as might possibly become the means of effecting a considerable reduction upon the general expense."

The views we have given will shew the character of the intended building. But as comparison is probably the best test that can be adopted, we may state that the proposed building was to be more than four times the length of either Westminster Abbey, St. Paul's Cathedral, or York Minster, and in width more than double that of St. Paul's or York Minster at the transepts. Its intended dimensions were 2200 feet long, 450 feet wide, and 60 feet in height. The great dome, which was added by the Building Committee, with the intention of giving a fixed character to the structure, was to have been 150 feet in height and 200 feet in diameter, it would therefore have been 11 feet in diameter larger than that of St. Peter's at Rome, and 45 feet larger in diameter than that of St. Paul's Cathedral. Some averred that it would be impossible to construct it within the specified time; others prophecied that it would fall about the ears of the Commissioners, while the fiercest opposition was raised to the erection of so vast a structure of bricks and mortar within the Park, the walls of which were to be 60 feet in height, and in parts nine feet in thickness. But the great dome, its 'dis-

tinctive feature,' was of all other things most unpopular. At the same time very great controversy arose as to the site; proceedings were even attempted to be instituted in the Court of Chancery to restrain the Commissioners from building thereon. All these objections were overcome, and the suggestions which had been so carefully elaborated by the Commissioners, superseded by the simple proposition of a gentleman, who had no reputation either as a builder or architect, but who had been known to the scientific world only up to that time as an indefatigable and sagacious botanist and gardener.

While party spirit and newspaper discussion were producing their angry recriminations, Mr. Paxton was busily engaged on a plan which was destined to eclipse all the engineering and architectural designs of the country. The idea of this gigantic and beautiful structure, so vastly preferable to the brick and mortar fancy, and the great features of the Committee, was conceived by him in a short space of time. His vast experience in the construction of other great buildings fitted him for the task he had assigned himself, and although not without much forethought, it is remarkable that while attending to his duties as a Railway Director in the Board Room at Derby, he sketched on the sheet of blotting paper, which lay before him, the outline of the plan which he has since so ably perfected: but we must here let Mr. Paxton speak for himself, in an extract from his address at the Derby Institute:

"It was not until one morning when I was present with my friend, Mr. Ellis, at an early sitting in the House of Commons, that the idea of sending in a design occurred to me. A conversation took place between us with reference to the construction of the new House of Commons, in the course of which I observed, that I was afraid they would also commit a blunder in the building for the Industrial Exhibition; I told him that I had a notion in my head, and that if he would accompany me to the Board of Trade I would ascertain whether it was too late to send in a design. I asked the Executive Committee whether they were so far committed to the plans as to be precluded from receiving another; the reply was, 'Certainly not, the specifications will be out in a fortnight, but there is no reason why a clause

should not be introduced allowing of the reception of another design.' I said, 'Well, if you will introduce such a clause, I will go home; and in nine days hence I will bring you my plans all complete.' No doubt the Executive thought me a conceited fellow, and that what I had said was nearer akin to romance than to common sense. Well, this was on Friday the 11th of June. From London I went to the Menai Straits to see the third tube of the Britannia Bridge placed, and on my return to Derby I had to attend to some business at the Board Room, during which time however my whole mind was devoted to this project; and whilst the business proceeded I sketched the outline of my design on a large sheet of blotting paper. I am sorry I have not the original with me, but the fact is, Mrs. Paxton has taken possession of it, and if you are at all anxious to see it, the only possible way of gratifying that desire is by sending for her to the meeting. Well, having sketched this design on blotting paper, I sat up all night until I had worked it out to my own satisfaction; and by the aid of my friend, Mr. Barlow, on the 15th, I was enabled to complete the whole of the plans by the Saturday following, on which day I left Rowsley for London. On arriving at the Derby station I met Mr. Robert Stephenson, a member of the Building Committee, who was also on his way to the Metropolis. Mr. Stephenson minutely examined the plans, and became thoroughly engrossed with them, until at length he exclaimed that the design was just the thing, and he only wished it had been submitted to the Committee in time. Mr. Stephenson, however, laid the plans before the Committee, and at first the idea was rather pooh-poohed; but the plans gradually grew in favour, and by publishing the design in the *Illustrated News*, and shewing the advantage of such an erection over one composed of fifteen millions of bricks and other materials, which would have to be removed at a great loss, the Committee did in the end reject the abortion of a child of their own, and unanimously recommended my bantling. I am bound to say that I have been treated by the Committee with great fairness. Mr. Brunel, the author of the great dome, I believe was at first so wedded to his own plan, that he would hardly look at mine. But Mr. Brunel was a gentleman, and a man of

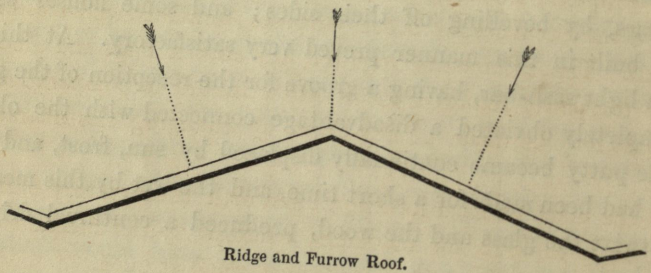
fairness, and listened with every attention to all that could be urged in favour of my plans. As an instance of that gentleman's very creditable conduct, I will mention that a difficulty presented itself to the Committee as to what was to be done with the large trees, and it was gravely suggested that they should be walled in. I remarked that I could cover the trees without any difficulty; when Mr. Brunel asked, 'Do you know their height?' I acknowledged that I did not. On the following morning Mr. Brunel called at Devonshire House, and gave me the measurement of the trees, which he had taken early in the morning, adding, 'Although I mean to try to win with my own plan, I will give you all the information I can.' Having given this preliminary explanation of the origin and execution of my design, I will pass over the question of merit, leaving that to be discussed and decided by others when the whole shall have been completed."

It was in the year 1828 when Mr. Paxton first turned his attention to the building and improvement of glass structures; the various forcing-houses at Chatsworth, as at other places, were formed of coarse thick glass and heavy woodwork, which rendered the roofs dark and gloomy, and, on this account, very ill suited for the purposes they were intended to answer. His first object was to remove this evil, and in order to accomplish it, he lightened the rafters and sash-bars, by bevelling off their sides; and some houses which were afterwards built in this manner proved very satisfactory. At this time he contrived a light sash-bar, having a groove for the reception of the glass; this groove completely obviated a disadvantage connected with the old mode of glazing, the putty became continually displaced by sun, frost, and rain, after the sashes had been made for a short time, and the wet by this means finding its way betwixt the glass and the wood, produced a continual drip in rainy weather.

About this period the desire for metallic roofs began to extend in every direction; and as such structures had a light and graceful appearance, it became a question of importance as to the propriety of using metal sashes and rafters, instead of wooden ones, for horticultural purposes. After carefully observing the effects of those built by various persons, it became apparent to him that the expansion and contraction of metal would always militate against

its general adoption, as at no season of the year could the sashes and rafters be made to fit.

In the construction of glass houses requiring much light, there always appeared an important objection, which no person seemed to have taken up or obviated; it was this. In plain lean-to, or shed roofs, the morning and evening sun, which is on many accounts of the greatest importance to forcing fruits, presented its direct rays at a low angle, and, consequently, very obliquely to the glass. At those periods most of the rays of light and heat were obstructed by the position of the glass and heavy rafters, so that a considerable portion of time was lost both morning and evening; it consequently became evident that a system by which the glass would be more at right angles to the morning and evening rays of the sun, would obviate the difficulty, and remove the obstruction to rays of light entering the house at an early and late hour of the day. This led Mr. Paxton to the adoption of the ridge and furrow principle for glass roofs, which places the glass in such a position that the rays of light in the mornings and evenings enter the house without obstruction, and present themselves more perpendicular to the glass at those



Ridge and Furrow Roof.

times when they are the least powerful, whereas at mid-day, when they are most powerful, they present themselves more obliquely to the glass. Having had this principle fixed in his mind, and being convinced of its importance, he constructed a pine-house in 1833 as an experiment, which still exists unimpaired, and has been found fully to answer the purpose.

In 1837 the foundation of the Great Conservatory was commenced, and in constructing so great a building, it was found desirable to contrive some means for abridging the great amount of manual labour that would be required in making the immense number of sash-bars requisite for the purpose. Accordingly, Mr. Paxton visited all the great workshops in London, Manchester, and Birmingham, to see if anything had been invented that would afford the facilities he required. The only apparatus met with was a grooving machine, which he had at once connected with a steam-engine at Chatsworth, and which was subsequently so improved as to make the sash-bar complete. For this apparatus the Society of Arts, in April, 1841, awarded him a medal; and this machine is the type from which all the sash-bar machines, found in use throughout the country at the present time, are taken. As the Conservatory was erected under his own immediate snperintendence, we have the most satisfactory authority as to the advantages of the machine: it has, in regard to that building alone, saved in expenses £1400. The length of each of the bars of the Conservatory is 48 inches; only one inch shorter than those of the Exhibition Building. The machine was first used in its present form in August, 1838; and its original cost, including table, wheels, and everything complete, was £20. The motive power is from a steam-engine employed on the premises for other purposes; and any well-seasoned timber may be used. The attendants required are only a man and a boy, and the expense of the power required for it when in use is comparatively trifling. The sash-bars may be made of any form, by changing the character of the saws.

Thus, in the machine used for the Chatsworth conservatory bars, each bar was passed *twice* through the machine; whereas, by the machine now used, the operation of moulding both sides is performed at once.

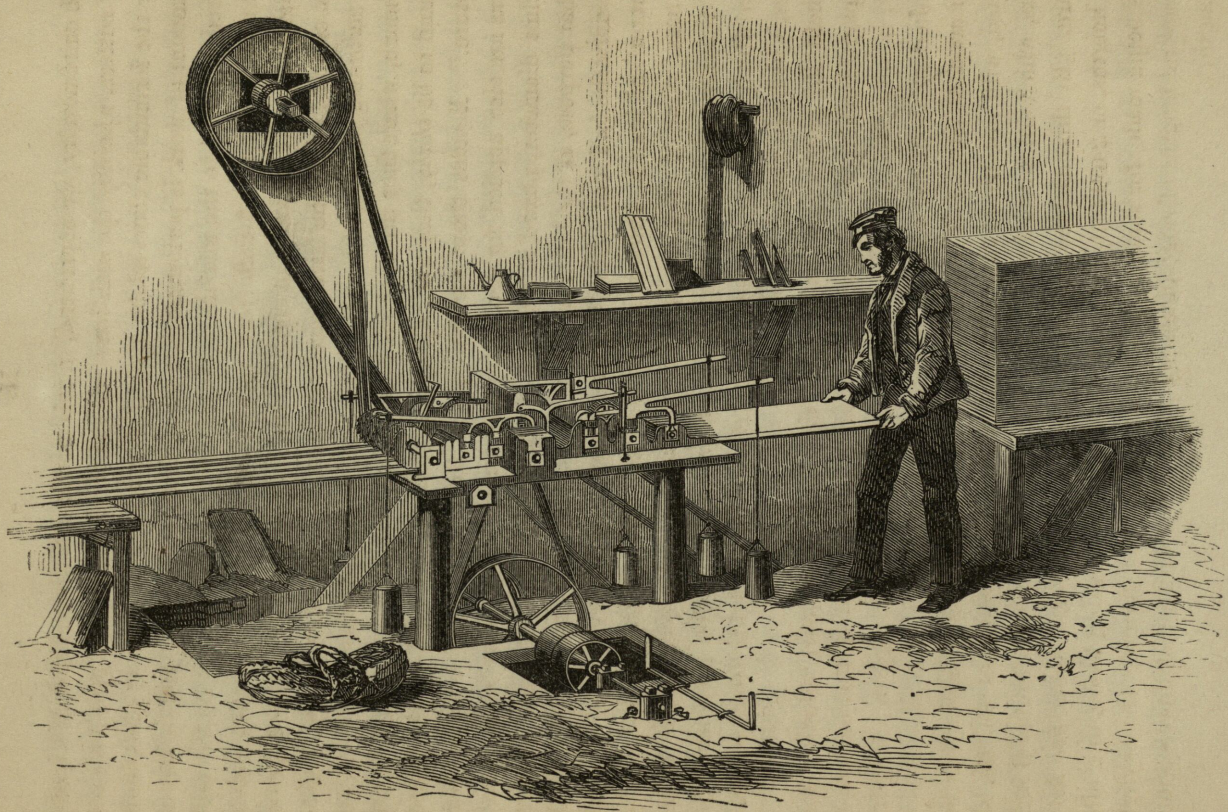
We subjoin a representation of the improved *sash-bar cutting machine*, as used and invented by Mr. Birch, of the Phœnix Saw-mills, near Cumberland-market, Regent's-park, who contracted for supplying skylight bars for the great Building, as also the upright bars for the vertical lights, and ridge-pieces for the skylights.

The chief novelty, we apprehend, in this machine, is the addition of a second set of cutters, whereby the sash-bars, instead of passing twice, pass *only once* under the formidable claws which give to them their proper form; thus double the amount of work is performed in a given time. One man and a boy are required to attend to the machine: the former places the planks on the table, to be received by the 3-inch *feed* rollers, which, having parallel indents throughout, in the direction of their length, cause the planks to move forward to the cutters: while the latter receives three, four, or more of the finished bars, according to the width of the plank, and removes them to the floor, near to a bench, where they are examined and cut to their proper length of 15 feet. If found to be *shaky*, they are rejected as unfit to be used in the "model structure." Besides those for cutting out the moulded or bevelled parts, cutters are also applied for separating the bars; but circular saws, each of 8 inches diameter, placed in advance of the moulding cutters, are preferred for that purpose, as the latter are more easily blunted by knots in the wood.

Besides the two feed rollers, there are also three *pressure* rollers, of similar diameter and length, which is regulated by the width of the plank to be cut into bars. One of the pressure rollers is placed in the rear of the cutters, and the other two in front: and in connection with the pressure rollers, under which the planks severally pass, are suspended weights from adjustable levers, which are seen in the view.

About 307 planks pass through this machine in ten hours, allowing for a stoppage of about ten minutes in each hour for sharpening the cutters, &c. Now, if only three bars are produced out of each plank, it gives a length of sash-bars of about *two miles* and *three-quarters* per diem.

In another part of Mr. Birch's premises a moulding machine has been applied, with suitable modifications for cutting the ridge-pieces for the sky-lights, which are finished to 24-feet lengths, and cut out of fir timber 3 inches square. By this machine, which is worked with a power of about *five horses*, 100 lengths, or 2400 feet, are produced in the ten working hours, due allowance being made for sharpening the cutters, &c. In forming the skylights, the several lengths of ridge-pieces are put together with $\frac{1}{2}$-inch dowels 3 inches in length.



Sash Bar Cutting Machine.

The glass and glazing of the Chatsworth Conservatory caused Mr. Paxton considerable thought and anxiety, as he was very desirous to do away altogether with the numerous overlaps connected with the old system of glazing with short lengths. This old method, even under the best of management, is certain, in the course of a few years, to render unsightly any structure, however well built.

In the course of his enquiries, he heard that Messrs. Chance and Co., of Birmingham, had just introduced from the Continent the manufacture of sheet glass. He accordingly went to see them make this new article, and found they were able to manufacture it three feet in length. Mr. Paxton says, "I was advised to use this glass in two lengths, with one overlap: but to this I could not assent; as I observed, that since they had so far advanced as to be able to produce sheets three feet in length, I saw no reason why they should not accomplish another foot; and, if this could not be done, I would decline giving the order, as, at that time, sheet glass was altogether an experiment for horticultural purposes. These gentlemen, however, shortly afterwards informed me that they had one person who could make it the desired length; and, if I would give the order, they would furnish me with all I required."

It may just be remarked here, that the glass for the "Palace of Industry" is forty-nine inches long—a size which no country except England is able to furnish in any large quantity, even at the present day.

In order to give the roof a light and graceful appearance, it is built on the ridge and furrow principle, and glazed with British sheet glass, as previously described. The rafters are continued in uninterrupted lines the whole length of the building. The transept portion, although covered by a semicircular roof, is also on the angular principle.

All the roof and upright sashes being made by machinery, are put together and glazed with great rapidity; for, being fitted and finished before they are brought to the place, little more is required on the spot than to place the finished materials in the position intended for them.

On the 26th July last (1850) the Building Committee, as late as six o'clock in the evening, came to the resolution to adopt, and decided finally on

the details of Mr. Paxton's plan, and it was determined that the roof of the longitudinal portion should be flat, and that there should be the addition of the great transept, to break the monotony of the long straight line of glass, to be covered in by a large barrel roof in order to avoid the necessity of felling the large trees now contained within the building.—Happily for our national reputation, the Committee and the Commissioners were not insensible to the public dissatisfaction so very strongly expressed towards their own favoured plan, and their pet feature, its colossal dome; they felt that the design proposed by Mr. Paxton was eminently suited, on account of its great simplicity and novelty, its lightness and elegance, as well as from its convenience, for the purposes for which it is destined; it is, moreover, a monument of ingenuity, which will stand unrivalled throughout the world.

Mr. Paxton submitted his plan to the Messrs. Fox and Henderson of the Smethwick Works, Birmingham, who were among those who tendered for the original building of brick. A wise provision had been made by the Committee, which permitted the contractors to make suggestions in reference to the works, provided they were accompanied by detailed plans and estimates. Messrs. Fox and Henderson seeing at a glance that this design was the most suitable for the purpose, at once recommended it to the Commissioners, undertaking at the same time to furnish the details and estimates within one week; the result was, as we have stated, its final acceptance. The contract was signed for £79,800, for what is technically called "use and wear;" if the structure remains, and becomes the property of the public (of which there seems to be but little doubt), the cost is to be £150,000.

Messrs. Fox and Henderson forthwith entered upon their labours. Gigantic orders ensued for iron columns and girders—for thousands of feet of glass and forests of wood; hundreds of busy hands were instantly set to work on the site in Hyde Park; an ingenious hoarding, without a nail, was thrown up as if by magic; and suddenly, on the morning of the 26th of September, the passers-by were astonished to see the first of the 3,300 columns reared on high, and standing at right angles from the ground, permanently fixed.

The dimensions of the building are 1,848 feet long by 456 feet wide, in the

broadest part; the whole divided into multiples of 24. The space occupied on the ground floor is 752,832 superficial feet, and the space provided in the galleries is 102,528 feet. The height of the centre roof is 64 feet, the adjacent avenue 44 feet, and the outer sides 24 feet, while that of the great transept is 108 feet. On either side of the main aisle and parallel with it are five additional avenues, three of which are each 24 feet wide, and two 48 feet wide. The total quantity of exhibiting surface is about 21 acres; but should the additional gallery be determined upon, an increased surface will be obtained to the extent of about 90,432 feet. The total cubic contents of the building is 33,000,000 feet. The quantity of glass required is about 900,000 superficial feet, and its weight is estimated at 400 tons. There are 3,300 cast and wrought iron hollow columns, varying from 14 feet 6 in. to 20 feet in length; 2,224 cast iron girders; and 1,128 intermediate beams for supporting the floors of the galleries.

The extreme load which could ever be placed on any one of the girders is 5½ tons, calculated upon the densest cram of people; but this weight could never be applied to them, because a considerable portion of the space would be occupied by tables; whereas every one has been tested by the hydraulic machine to the extent of 15 tons, the breaking weight being 30 tons.

There are 34 miles of gutter to carry off the water, and in no part of the building has the water to run more than 48 feet before it is delivered into the hollow columns; but the greater part has not more than half that distance to run. The length of sash bars is 205 miles. The whole of the lower tiers of the building, although boarded, is intended to be coloured to represent glass.

"It will be seen that this building is not what is usually termed an architectural structure. It is not built of wood, neither of stone, nor brick, but of iron. The architect deals with materials the strength of which is hardly ever the subject of calculation; brick is laid upon brick, and stone upon stone, without the slightest fear of their crushing from any weight they may have to sustain, and without much thought of the *quantities* to be used. The engineer on the contrary has to deal with iron, a material whose strength is

calculated in every situation in which it is used, and the economy in quantity reduced nearly to a *minimum*. Iron also differs altogether in appearance from brick and stone, which present large broad surfaces; while iron, on the contrary, presents such narrow surfaces, that it may be almost described as consisting of an assemblage of lines in the building now under consideration. These lines are made up principally of columns and girders."*

The walls of St. Paul's Cathedral are 14 feet thick, those of the Glass Building are only 8 inches. St. Paul's occupied 35 years in building, while this structure has been finished in about half the number of weeks.

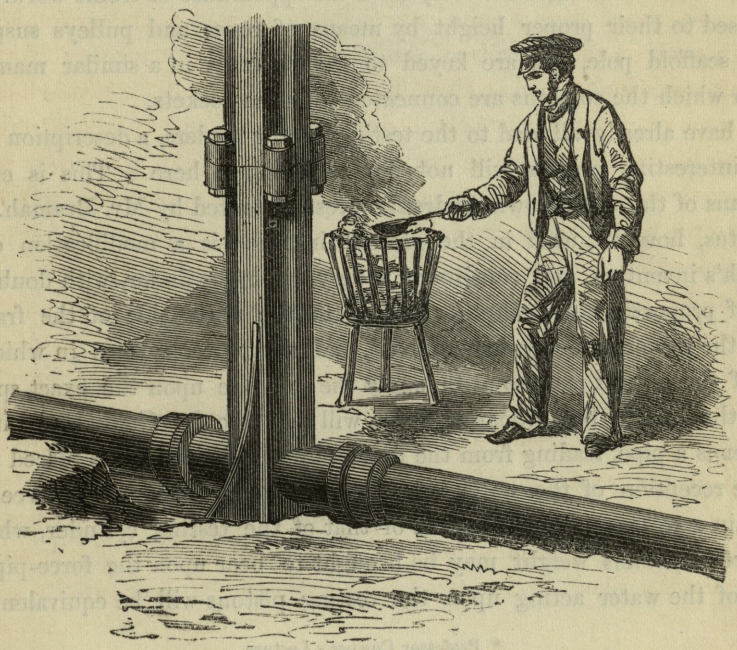
We will now proceed to the description of the details of this most remarkable building.

"The columns throughout rest on what is technically called concrete, composed of large stones mixed with 1-7th of sand and 1-7th of lime; the whole being incorporated with a sufficient quantity of water, the gravel is taken from pits sunk on the premises. An iron tubular socket, from three to four feet long, according to the levels of the ground, which differ throughout, and of the same diameter as the column itself, is placed upon the concrete when dry; the bottom of the socket, being very broad and flat, is firmly fixed to the concrete by cement. To fix the socket exactly in its right place, with regard to the rest of the sockets, is indeed a very nice point; and a repetition of this operation constituted, in fact, the 'setting out of the building.' A theodolite for marking the direction, a 24-feet rod to measure the distances, and wooden stakes, each having a nail driven into it, to mark the point corresponding with the centre of the respective columns, were required in the 'setting out.' When the concrete was put into the holes dug for its reception, the stakes were necessarily removed, and the socket was adjusted to its exact position by means of a triangular wooden frame, points in two of the angles resting on the nails of two stakes, the other limb having a semicircular end, to fit the outside of a contiguous socket already fixed in its place. Perhaps there never was a ground-

* Professor Cowper's Lecture at the Industrial Palace.

plan of similar character set out with such wonderful exactness—its beauty and accuracy meet you at every step you take.

"Column covers column with as much truth as if their places were set out on a sheet of paper, instead of on an area of 18 acres of ground. The sockets being fixed in their places, the lower columns, 18 feet 8 inches high, are fixed upon them by bolts and nuts; then a connecting piece, 3 feet 4½ inches high; then another column, 16 feet 7½ inches high; then another connecting piece, and so on, the whole fitted together like the joints of a telescope. There are in the whole building 2,500 columns, the first of which was fixed in its place on the 26th of September last. It is of the greatest importance that these columns and connecting pieces should stand perfectly upright one upon another. In the usual way, the ends of these columns and



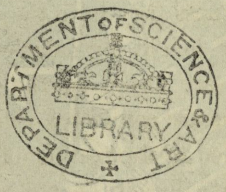
Drainage pipes.

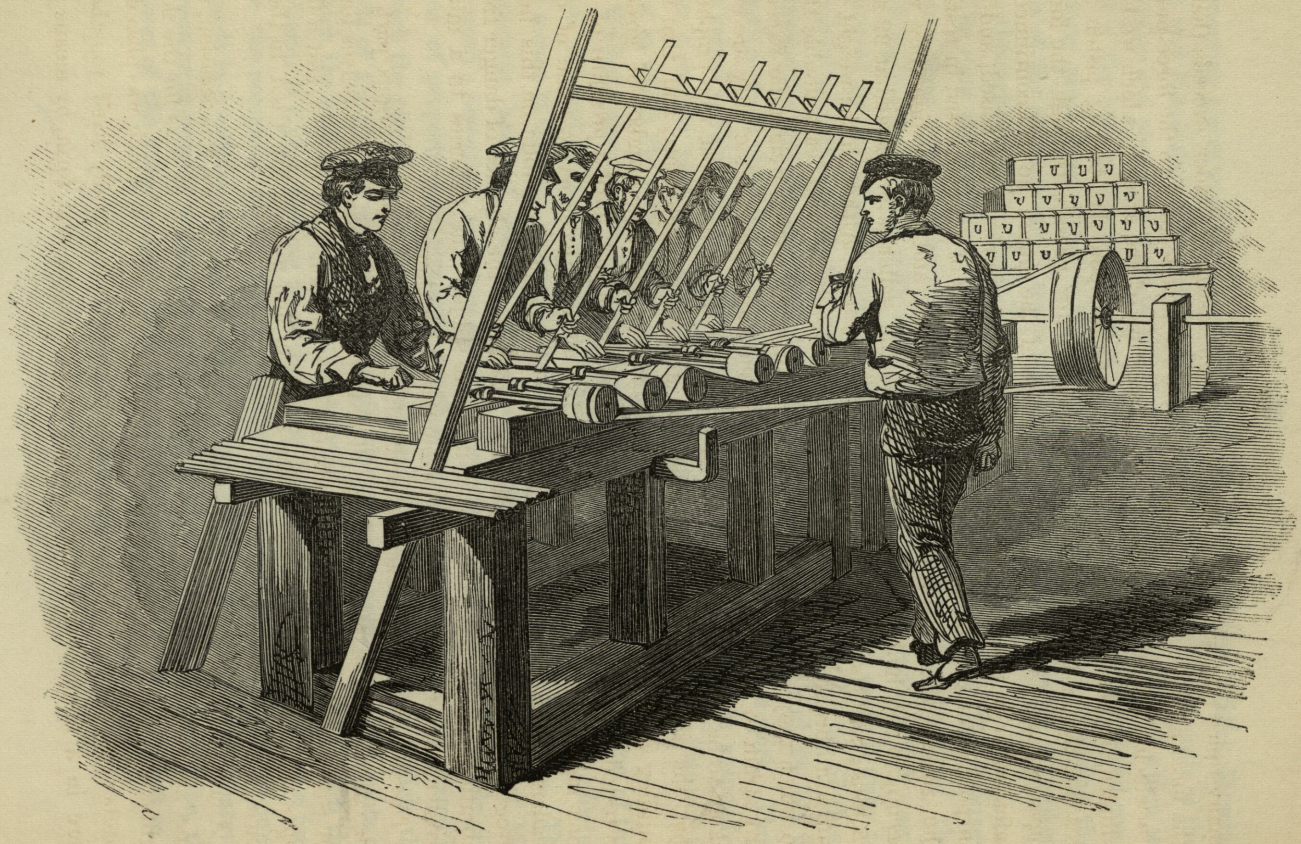
connecting pieces would have been *chipped* and *filed;* and here, I think, Messrs. Fox and Henderson shewed considerable tact in turning the 12,000 ends of the columns and pieces, or what is called *facing* the ends; the effect of which is, that if the base of the socket is placed perfectly level, the columns and connecting piece *must* stand upright. By the precaution taken of facing the ends of the columns and connecting pieces, you will not discover a crooked line throughout the building."*

The view we have here given will shew the construction of the drainage pipes—these pipes running underground throughout the length of the building are connected with each of the columns; they receive the water conveyed by the columns from the gutters on the roof, and carry it away to a culvert constructed at the east end of the building. At the top of these columns the girders are fixed, they are formed of cast iron, and 24 feet in length;—from their lightness they have the appearance of trellis work. They are raised to their proper height by means of ropes and pulleys suspended from a scaffold pole, and are keyed to the columns in a similar manner to that in which the columns are connected with the sockets.

We have already alluded to the testing of the girders, a description of this most interesting process will not be out of place here. This is effected by means of the well-known hydraulic press, invented by Mr. Bramah. The apparatus, however, used in the present instance is a modification of Mr. Bramah's invention, and consists of a very strong cylinder, with double pistons of proportionate strength attached to the under side of the frame in which the girder to be tested is fixed, and through openings in which the ends of the pistons pass, so as to apply the pressure upon the exact spots on which the load to be ultimately borne will be placed. Connected with this cylinder is a pipe, leading from the force pump, below which is placed a tank for the reception of the water. If the area of the bore of the force-pump stands in a certain ratio to the area of that of the testing cylinder, whatever pressure in pounds weight may be brought to bear upon the force-pipe, the power of the water acting upon the testing pistons will be equivalent to as

* Professor Cowper's Lecture.


DEPARTMENT OF SCIENCE & ART
LIBRARY



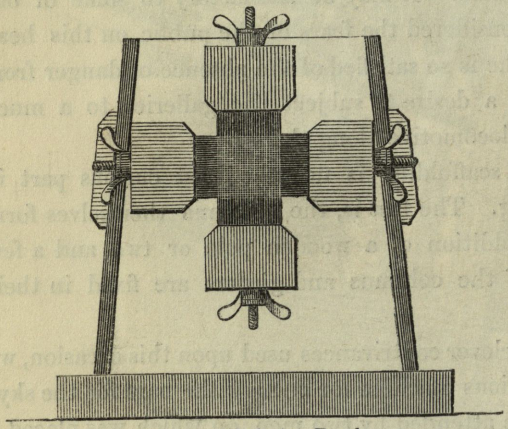
Drilling Machine

many times that weight as the area of the testing cylinder exceeds that of the force-pump. A valve is attached to the pipe leading to the force-pump, on which a weight, regulated by the proportion of the areas to which we have alluded, is placed. As soon as the pressure upon the testing piston has reached the desired force, the compressed water presses through the force-pipe and raises the weight. If the action of the pump be still continued, a safety-valve in the cylinder of the force-pump is immediately raised, and the surplus water returns to the tank. The amount of pressure used in testing the girders varies according to their strength, and the position they will occupy in the building: those supporting the galleries are tested at 22 and 15 tons; and those which bear the roof at 9 tons. Although the weight required to break any of these girders would probably be at least double that to which they are respectively tested, the latter, or testing weight, far exceeds any strain to which the most liberal calculation can imagine they are ever likely to be exposed. This test must effectually silence those who prophecy that the strength of the columns and girders is inadequate, and that the building will "come down with a run." Out of the large number of girders so tested but six of them have broken, and those not until a pressure of 30 tons had been exerted upon them. It may be satisfactory to some of our readers to state that Mr. Fox considered the fears of the public on this head altogether unfounded; indeed, he is so satisfied of the absence of danger from vibration, that he has expressed a desire to subject the galleries to a much greater test—that of running a locomotive along them!

The almost entire absence of scaffolding is not the least curious part in the construction of the building. The fact is, the columns themselves form the scaffolding; and with the addition of a wooden pole or two, and a few ropes and pulleys, the whole of the columns and girders are fixed in their places.

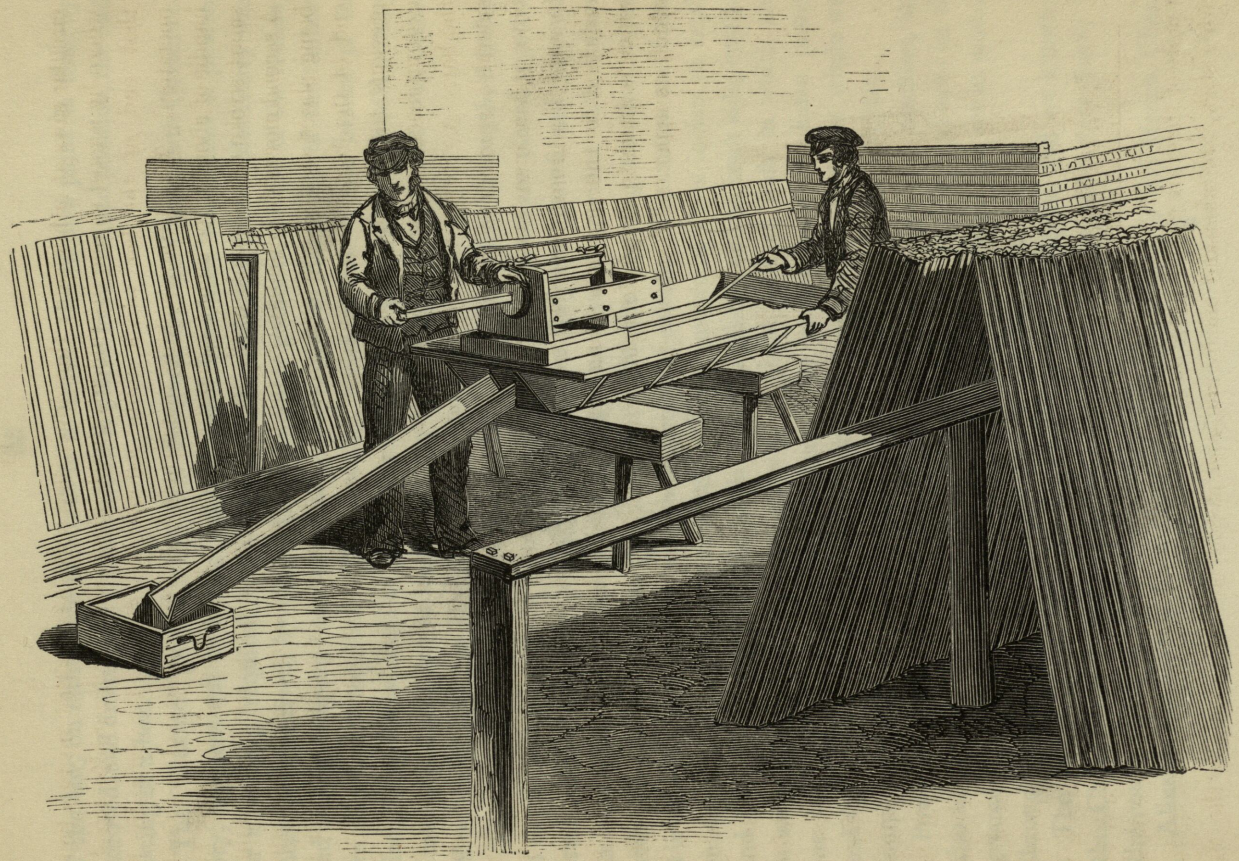
Among the many simple and clever contrivances used upon this occasion, we must not omit to notice an ingenious machine for cutting the bars for the sky-lights, which consisted of a table attended by two men, on which was placed a number of short lengths of sash-bars; these being firmly fixed together, were in a moment reduced to their proper length and form, by means of

circular saws at either side; this done, they were next passed on to a bench, where by a most simple instrument, the shoulder, with the requisite bevel of that end of the bar which abuts against the gutter, is made by one operation. This little machine, constructed of iron, consists of a rounded handle of about three inches in length, to which a knife is attached, which by a smart stroke of the man's hand, cuts off the square piece to form the shoulder. A second moveable knife fixed to the handle works on a small pivot, and which being placed at the proper angle, is brought up, and instantly bevels off the end of the bar. The next stage in the progress of this little sash-bar, previous to its being handed over to the painter, is its removal to the drilling machine, a simple contrivance to make the nail-hole at either end of the bar. A representation of this machine, which seemed to occupy a considerable amount of attention, will be found on the preceding page. Four boys and a man were at work, each attending a drill; the bar is pushed forward in a groove towards the drill by which it is perforated. The proper direction to the nail-hole being determined by the inclination of the bar, which is made to drop into another groove cut in the wooden rail, against which its upper end rests.



Section of Painting Brush.

The sash-bar so finished, then passes into the hands of the painter—if, before, we had reason to express our wonder at the ingenuity of the machinery for abridging labour, surely here it has been adopted with even greater success—most of us know how tedious a process is that of hand-painting in sash-bars. The sash-bar having been primed, a dozen or more of them are placed into a tank filled with paint; these being well stirred with a stick, are taken out one by one, and passed through a groove the size



Painting Machine.

of the bar, on either side of which is a brush; the surplus paint is thereby removed, and drains into a shute which is placed in an inclined position, the end resting in a box.

The 'Paxton' gutters when first designed for the Chatsworth Conservatory, were cut out by hand; but this would have been too tedious a process for a building required to be executed in so short a time. Machinery was therefore contrived, by which the rain-water gutter in the top of the timber, and the two sloping 'condensation' gutters, one on either side of the timber, are all cut out together. The machine, which is one of the busiest of its kind, turns out of hand in about five minutes as much work as would occupy a man the whole day at least. Thus a total length of 2112 feet was carted off to the building in Hyde Park each day.

The timber for the gutters is sawn into pieces of 24 feet in length, 6 inches in depth, and 5 inches in thickness. Three of these pieces are placed together firmly on the frame of a planing mill, where they are planed and squared. In this state one of the pieces is placed on a stand provided with rollers, with one end inserted in the iron frame of the grooving machine, where it is brought into contact with three grooving chisels. The centre one forms on the under surface of the wood a circular groove of three inches in depth and about the same in width, while the two others, one on each side, cutting in an oblique direction, form grooves of about half an inch in width and one in depth. The machine is worked by an engine of 20-horse power, and forms about three feet of the gutters per minute; so that the whole was completed in two months, the number of feet required being 126,720.

Power is given off from the engine to a circular planing machine, and also to the gutter machines on the first-floor, whilst two vertical saws on the ground-floor, and a second planing and adzing machine are set in motion, through the medium of a second shaft in the basement.

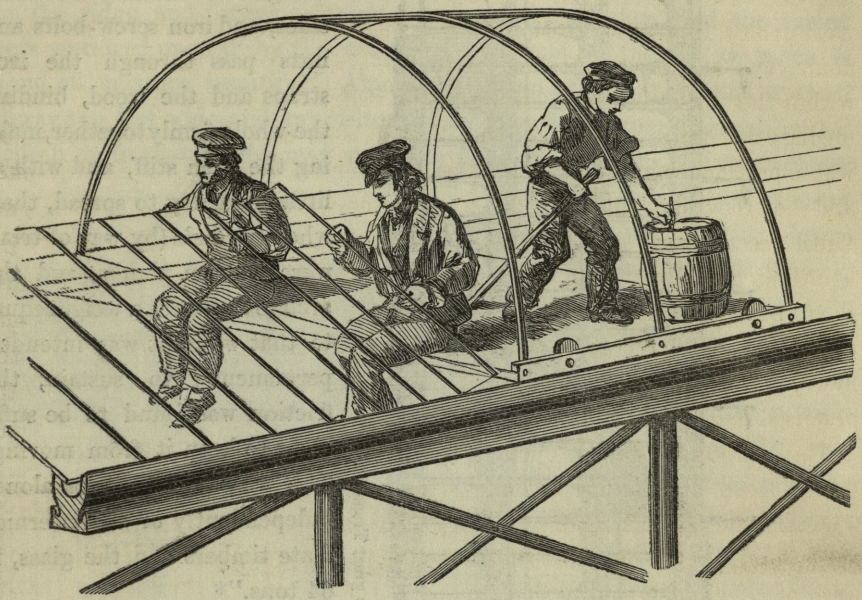
The workshops are situated near the Thames at Chelsea, and are known as the Chelsea Wharf Saw Mills, they were taken by the contractors chiefly for the construction of the Paxton Gutters.

Allusion has already been made to the Glass Works of the Messrs. Chance

and Co. These gentlemen contracted to supply the vast quantity of glass used upon the present occasion, amounting to nearly 400 tons. Considerable doubt was at first entertained as to the possibility of executing the order within the prescribed time, owing to the scarcity of skilled hands. The immediate assistance of Belgian and French workmen, was, however, obtained, whose proficiency in this branch of art has long been known to excel our own: and thus they were enabled to keep up an uninterrupted supply of the material. Until recently, as we have before stated, even in these works, the largest length of glass ever made was 3 feet; it was only when the ingenuity of Mr. Paxton urged them to greater exertion, that the size we have now in use was produced. The process of its manufacture, is one of extreme interest and nicety: it requires the utmost care and precision, as well as a very steady and practised hand.

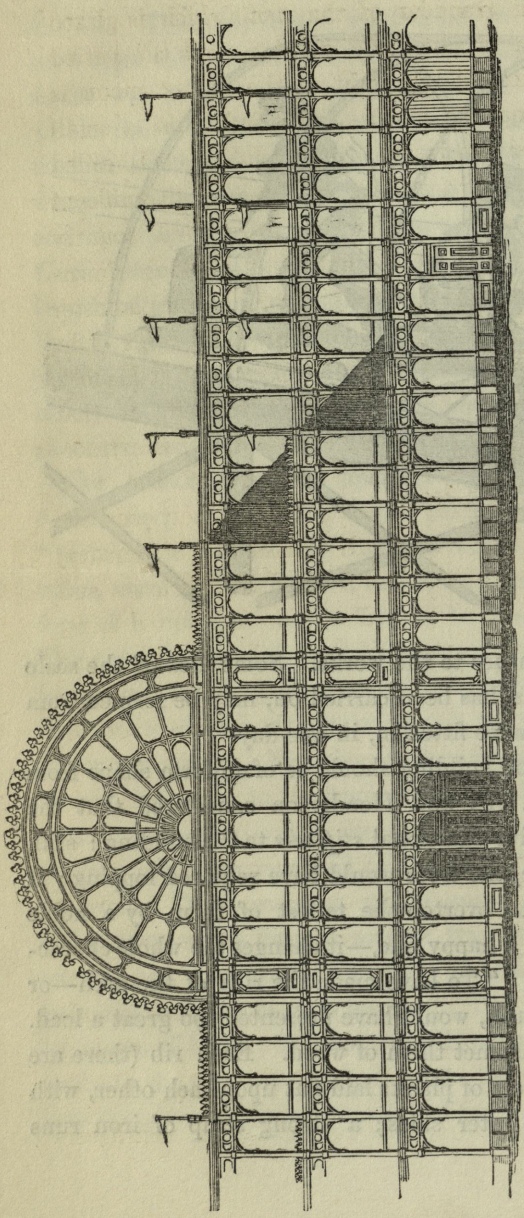
The workman stands upon a raised platform, with a pit some 5 or 6 feet deep at his feet, when having obtained the necessary weight of "metal," he swings the tube to which it is attached, round and round again, until he has obtained the desired size; but the glass is then only in the form of a cylinder, and it has to be disconnected from the blowing tube. This operation is performed by boys with strings of red hot glass. The tube is then cut, and the glass removed to the flattening kiln, where after a moderate application of heat it is flattened and burnished, and soon reduced to a state fit for the glazier. The glass is then packed in boxes and dispatched for use; we will follow it to its destination, although hardly cold from the furnace.

Arrived on the ground, we observe a number of small machines, not unlike bathing machines, mounted on the roof of the building; these are the glazing waggons. These waggons are mounted on four wooden wheels running on the gutters, which form a sort of tram road; they are guided by a boy, who propels the machine as the men progress with the glazing: two men are generally working in each waggon. The box of glass is raised to the waggon by means of ropes. The sash-bars being already prepared, and the glass made ready to the size, there is but little else for the men to do, than to drop it into the groove. In wet weather these waggons are covered over with a light



canvass, so that no interruption ensues to the works. Some idea of the scale on which this portion of the works has been carried on, may be formed from the fact, that 8000 panes of glass were fitted in, in one day.

"At first, it was intended that the building should be of uniform shape from one end to the other; but Messrs. Fox and Henderson considered that the introduction of a transept would give additional *stiffness* to the building: still, with a flat roof as that of the nave, the trees would have required lopping; it was, therefore, boldly determined to overtop the tallest of them by a noble arch." The idea of a transept was a happy one,—it changes the whole character of the interior of the building. "To have made the ribs of the arch—or principals, as they are called—of iron, would have presented too great a load. It was therefore determined to construct them of wood. Each rib (there are 16 of them) is composed of four layers of planks laid flat upon each other, with curved planks on the inner and outer sides; a strong strap of iron runs



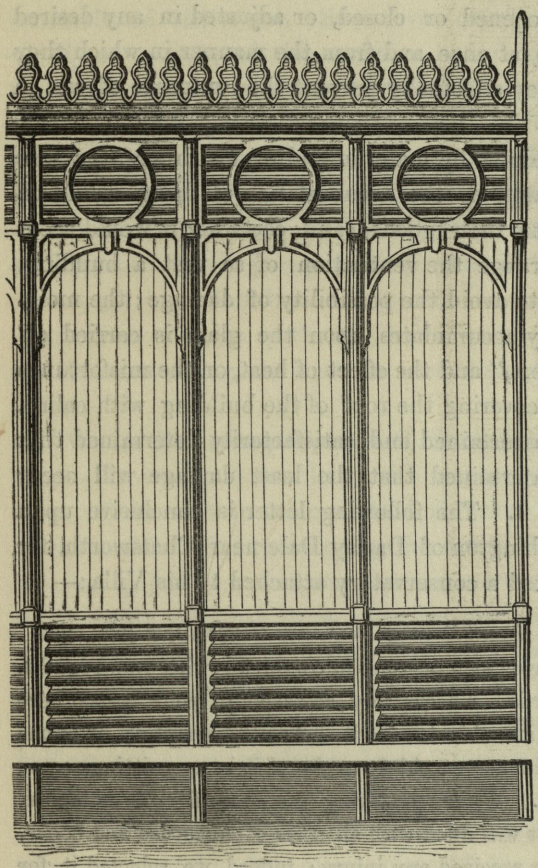
Elevation of the great Transept.

along the inner and outer sides, and iron screw-bolts and nuts pass through the iron straps and the wood, binding the whole firmly together, making the arch stiff, and with so little tendency to spread, that, when the ends (by way of trial) were put on planks, and the arch loaded with a weight equal to that which it was intended permanently to sustain, the friction was found to be sufficient to keep it from moving. The weight of the ribs alone, independently of the intermediate timbers and the glass, is 64 tons."*

The raising of these ribs was a work of considerable interest; it required a force of some 30 or 40 men to deposit them in their respective sockets. The arrangements necessary for carrying out this important and interesting part of the work, were conducted by Mr. Fox in person, and so perfect were they, that not more than two hours elapsed ere each pair of ribs was de-

* Professor Cowper.

posited in its place. The exceeding grandeur of the roof, which is glazed upon the ridge and furrow principle, is singularly striking, and the varied effects produced upon it by the action of the light of the sun or moon is beyond all measure beautiful. Along the crown of the arch runs a small pathway two feet wide, and any visitor sufficiently adventurous and cool-headed to climb up to that height may not only feast his eyes upon a magnificent view of town and country around, but, looking downwards through the monster window frame, 18 acres wide, which is spread out at his feet, may satisfy himself, at that dizzy elevation, of the extraordinary rigidity of the vast fabric at this its most sensitive point. On the 14th of January, half a hundred labourers and mechanics were mounted there, stamping, hammering, and otherwise engaged in a manner to test "the stiffness" of the arched roof, yet hardly any tremor or vibration was perceptible.



The important subject of ventilation has occupied much of the attention of the contractors; it was considered necessary to adopt some simple means by which a continuous stream of fresh air could be introduced without producing injurious drafts or currents. The ventilators

have a very simple appearance, and are easily opened or closed; the drawing we have given will shew their construction. The frame of the lower tier of ventilators (which is formed of 7-8ths deal), is 7 ft. long and 4 ft. 3 in. high, and 4 inches and a half deep. The blades or buffers are of sheet iron, forming a flat S curve. The upper tier of ventilators is similar to the lower, but instead of eight blades there are only five in each frame; they are seen behind the ornamental fan-lights. The blades are hung as a swing glass, and a length of 300 feet can be opened or closed, or adjusted in any desired way to regulate the temperature, at once, and from the manner in which they are placed over each other, they effectually prevent the entrance of wet in rainy weather.

Great fears have been entertained by many intending exhibitors, that the effect of the light and heat, as well as the accumulation of damp would be in the highest degree injurious to their goods; and certainly it would seem almost an impossibility so to arrange the ventilation of so vast a building, composed of such materials, as to avoid the possibility of damage; the moisture, however, which necessarily accumulates upon the glass is carried off through the "condensation gutters," and the effect of heat, or the misfortunes of hail, will be counteracted by covering the roof of the building with calico. It seems, therefore, to be well ascertained and satisfactorily determined that no fear need, at any time, be entertained that the least damage will occur to *any articles* exhibited within it. The following letter is conclusive upon these points, it is from Mr. Washington of Darley Dale near Chatsworth, for whom Mr. Paxton had constructed a conservatory attached to his Villa:—

"Darley Dale, near Matlock, 18th July, 1850.

"My Dear Mr. Paxton,—I have much pleasure in complying with your request, to state how the flat-roofed, boarded conservatory attached to your house here answers, and for what purposes I am able to use it. As a conservatory, it seems fully to answer its purpose. But the use we chiefly make of it is as a sitting-room; we find it so dry, light, and airy. While preparing the house for our residence, during the last winter and spring, it was filled with all sorts of furniture and books, pictures, &c., and a *piano:* nothing received any injury; indeed, we selected it for

being, what it has proved, the most dry and airy part of the house. I cannot conceive its construction could be improved so as to better answer the purposes for which you designed it.

"Believe me, dear Sir, sincerely yours,

"ADAM WASHINGTON."

With reference to the flooring, Mr. Paxton says:—"I have tried many experiments in order to find out the most suitable floors for the pathways of horticultural structures. Stone was objectionable on many accounts, but chiefly on account of the moisture and damp which it retained; and was therefore uncomfortable, especially to those wearing thin shoes. The difficulty of getting rid of the waste from the watering of plants, was also an objection; but perhaps the greatest was the amount of dust from sweeping, which always proves detrimental to plants. I likewise found that close boarding for pathways was open to many of the same objections as stone: for although damp and moisture was in part got rid of, yet still there were no means of immediately getting rid of dust. These various objections led me to the adoption of trellised wooden pathways, with spaces between each board, through which, on sweeping, the dust at once disappears, and falls into the vacuity below.

"Whilst the accomplishment of this point was most important in plant-houses, I consider it doubly so with respect to the Industrial Building, where there will be such an accumulation of various articles of delicate texture and workmanship. Before sweeping the floors of the Great Building, the whole will be sprinkled with water from a moveable hand-engine, which will be immediately followed by a sweeping-machine, consisting of many brooms fixed to an apparatus on light wheels, and drawn by a shaft. By this means, a large portion of ground will be passed over in a very short space of time.

"The boards for the floor will be 9 inches broad, and $1\frac{1}{2}$ inch thick, laid half an inch apart, on sleeper joists 9 inches deep and 3 inches thick, placed 4 feet apart.

"This method of flooring, then, possesses the following advantages:—It is very economical; dry, clean, pleasant to walk upon; admits of the dust

falling through the spaces; and even when it requires to be thoroughly washed, the water at once disappears betwixt the openings, and the boards become almost immediately fit for visitors.

"The galleries are laid with close boarding."*

There are four galleries—two called "Central," and running along the 24-feet aisles on either side of the main aisle; and two called "Side," filling the second row of 24 feet aisles from the centre. The galleries are surrounded with a light, simple and elegant cast iron railing, of a diamond pattern, designed we understand by Mr. Owen Jones, which giving a pleasing finish, will also add much to the appearance of the galleries. They are, too, an indispensable addition. Judging of the general effect of this part of the building from the varied and delightful views which at every point the finished portions present, the whole upper space, when completed, will, we believe, be found quite as attractive as the basement area itself.

Besides the centre aisle, which is to be kept clear, and the passage round the building close to the external wall, there are only two avenues open from end to end. These are eight feet wide, and are in the 24-feet aisles. The rest of the area, and especially the aisles of 48 feet wide, will be fitted up with tables of different shapes for exhibitors, and the hanging space between the pillars will be rendered available for the purposes of exhibition; cross passages, each eight feet wide—or if two, five feet wide—being kept clear in each section of 24 feet. The entire length of which will not be less than eight miles.

Not the least important part of the building will be the arrangements made for the refreshment of exhausted human nature; few of us, who may have devoted some hours to its inspection, or after perchance an eight mile walk, but will need some information as to the localities in which such provision may be found. These areas are to be fitted up as indicated in our plan for the sale of the following articles—in the Central Area: for ices, pastry, sandwiches, tea, coffee, lemonade, soda water, &c. &c.; Eastern and Western Areas, tea, coffee, bread, butter and cheese, ginger beer, soda water, and

* Lecture, Royal Society of Arts.

other such drinks—no cooking whatever will be allowed. A tariff of charges will be displayed in either area, any incivility or overcharge, will on complaint be attended by the discharge of the offender. Fresh filtered water is to be supplied gratis.

"Upon entering at the eastern end," (to quote the 'Morning Chronicle') "of the building, the productions of the United States will be arranged upon the north and south sides. Adjoining the United States will be the productions of Russia, also ranged upon both sides of the central passage. Norway and Sweden will occupy the space next to Russia, but upon the south side only. Exhibitors from Northern Germany will be placed on the north side next to Russia, and upon the south to Norway and Sweden. The productions of the Zollverein will occupy a considerable space upon both sides, adjoining to those of Northern Germany. Articles contributed by Austrian exhibitors will be placed next, also occupying a portion of each side of the central passage. The contributions from Holland join, on the north side, the Austrian productions. Belgium next occupies a fair amount of space upon each side. France has 240 feet of frontage upon the north, and about 200 feet upon the south side. To Portugal and Spain are allotted a space upon the north side, as well as to Italy. Switzerland will exhibit her productions upon the south side, and by their side will be arranged the articles to be sent from Brazil and Mexico. Egypt will occupy a space upon the north side, near to the transept, and in immediate proximity to some of the rich productions of Turkey. China has a frontage upon the south side, and a portion of that of the transept. Greece is in a similar position upon the opposite side; and Persia and Arabia adjoin to Greece and Turkey.

"Crossing the transept, the visitor will find himself amid the productions of British India, Ceylon, and the rest of our colonies, from which he will pass to the productions of the United Kingdom. The machinery in motion will occupy the north-western part of the building; the steam-engine, which will be of not less than 100-horse power, will be outside the building. The galleries will be allotted to the respective countries in almost the same proportions as the space upon the ground floor. It is understood that all the lighter and more elegant articles will be displayed in the galleries, the heavier

articles being of course exhibited upon the ground floor. Sculpture and the fine arts will occupy a position as near as possible to the transept. Articles of statuary and sculpture will be placed upon each side of the central passage, small fountains and other ornamental works being placed in the centre. At the centre of the intersection of the transept and nave, or central passage, will be a very beautiful glass fountain, with a basin of thirty feet diameter, to be supplied by Messrs. Chance, the eminent glass manufacturers."

There are four exits at the east end, four at the west, and six on the south side. The main entrances are three in number—one at the south end of the transept, extending along its entire breadth, and having seven doors, each of eight feet span; the others at either end of the centre aisle, each with nine doors, of a similar width.

We might almost conclude our remarks in the words of Professor Cowper.

"I look upon the original idea of Mr. Paxton as one of the most successful efforts of imagination and contrivance, and I consider the way in which Messrs. Fox and Henderson have made the bold conception *practicable*, one of the most successful and astonishing examples of contrivance, tact, science, industry, and perseverance, and engineering skill the world ever saw; and, whatever wonders may hereafter be placed in this building, the structure itself will be the greatest wonder of all."

The eye, accustomed to the solid heavy details of stone and lime, or brick and mortar architecture, wanders along those extended and transparent aisles with their terraced outlines, almost distrusting its own conclusions on the reality of what it sees, for the whole looks like a splendid phantasm, which the heat of the noon-day sun would dissolve, or a gust of wind scatter into fragments, or a London fog utterly extinguish. There, however, the Palace of Industry remains, a monument of the extent to which lightness of structure can be combined with permanence and strength, a building remarkable not less for size than for the beauty of mathematical proportions and rectangular outlines. The varied dimensions and fantastic features of other edifices there find no parallel. Everything is done by the rule, and yet everything is graceful, and it might almost be said grand. Wherever one stands no disagreeable effects present themselves—nothing crooked, awkward, or out of

place. The subordination of parts to the whole is complete, and an expression of order and exactitude reigns throughout, not unaptly typical of the progress which the mechanical sciences have made in this country. But for that progress this great building could never have been constructed, and it certainly is curious to reflect, now that the work has been accomplished, and the great result stands patent to the world, that with the facilities we possessed glass and iron have hitherto been so little employed by our architects.

The public will naturally be desirous to know the best points for looking at it, and the most striking effects which it presents. Unfortunately, the south side, which is the principal façade, stands so close to the public thoroughfare that its proportions cannot be seen to advantage. Like many other great structures which will readily suggest themselves to the mind of the reader, the Palace of Industry must be viewed from a distance to be appreciated. Whoever would see a great mountain to perfection, must not survey it immediately from its base, and on exactly the same principle the new edifice in Hyde Park cannot be well viewed from the Kensington-road. The drive along the Serpentine and the bridge over it are the best points for a spectator to select. There the ground rises, and the vacant space enables the eye to reach over a large proportion of the building. The trees partly shut out the prospect, but enough remains to astonish and to captivate. The vast extent of area covered, the transparent and brilliant character of the structure, the regular and terraced elevations, the light airy abutments, the huge transept, with its arched and glittering roof shining above the great vitreous expanse around it, and reminding one of nothing that he has ever heard of before,—all these things are worth seeing, and threaten to interfere seriously with the selectness of Rotten-row. The drive along the Serpentine should certainly be made the main carriage approach to the Exhibition, for visitors, by a good view of the exterior, will have their minds prepared to appreciate the industrial wonders collected inside."*

The Exhibition will be open every day (Sundays excepted.)

The hours of admission and other details will be announced at a subsequent period.

* The Times.

The charges for admission will be as follows :—

Season tickets for a gentleman . .	£3 3 0
Season tickets for a lady . .	2 2 0

These tickets are not transferable, but they will entitle the owner to admission on all occasions on which the Exhibition is open to the public.

The Commissioners reserve to themselves the power of raising the price of the season tickets when the first issue is exhausted, should circumstances render it advisable.

On the first day of exhibition, season tickets *only* will be available, and no money will be received at the doors of entrance on that day.

On the second and third days the price of admission on entrance will be (each day) . .	£1 0 0
On the 4th day of exhibition, 5th May .	0 5 0
To be reduced on the 22nd day (26th May) to	0 1 0

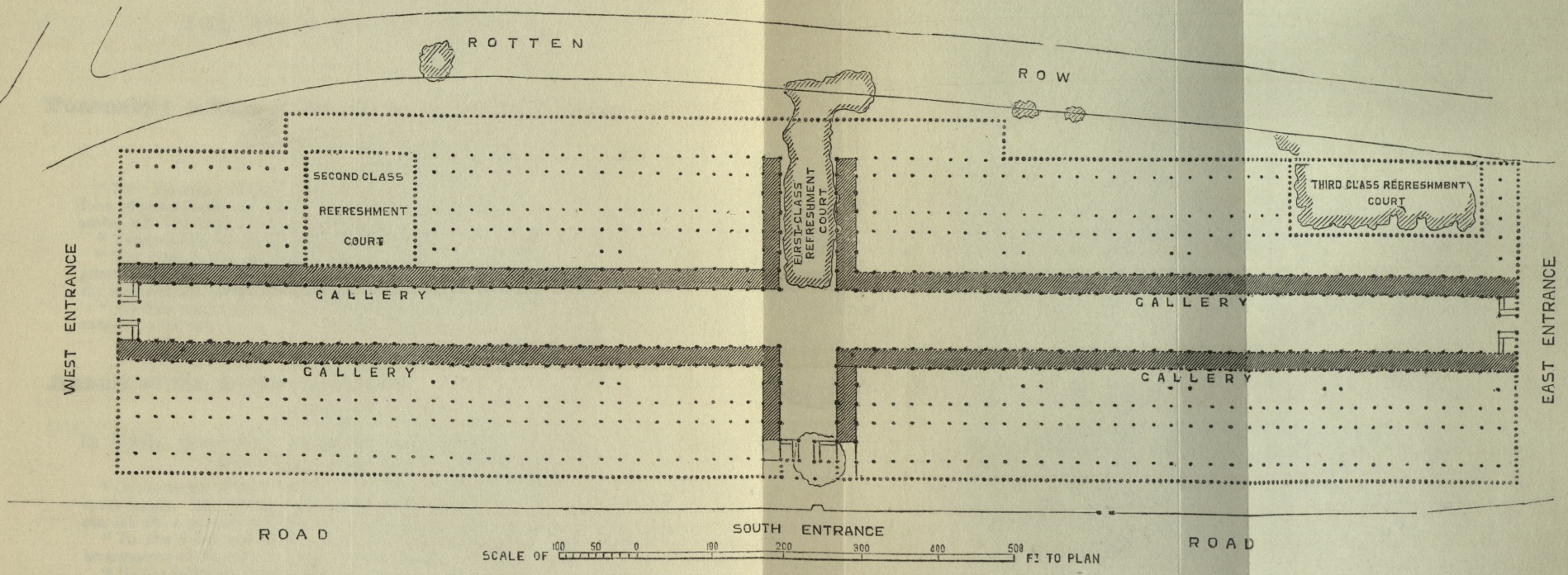
From the 26th May the prices of admission will be as follows :—

On Mondays, Tuesdays, Wednesdays, and Thursdays in each week	0 1 0
On Fridays	0 2 6
On Saturdays	0 5 0

No change will be given at the doors. This regulation is necessary to prevent the inconvenience and confusion which would arise from interruption or delay at the entrances.

Should experience in the progress of the Exhibition render any alterations in these arrangements necessary, the Commissioners reserve to themselves the power of making such modifications as may appear desirable, of which due and timely notice, however, will be given to the public.

LONDON : J. OLLIVIER, PRINTER, 59, PALL MALL.



GROUND PLAN OF THE PALACE OF INDUSTRY.

NEW WORKS

PUBLISHED BY

JOHN OLLIVIER,

59, PALL MALL, LONDON,

AND SOLD BY ALL BOOKSELLERS.

Ponsonby; a Tale of the Times of the Pretender.

Dedicated to Lord John Manners, M.P.

2 vols. post 8vo., price 18s.

"The 'Troublous Times' are those of 1745, and 'Ponsonby' is such an Englishman as Lord John Manners might have been, had he come into the world just a century earlier. . . . The author tells his story well, and with spirit."—*Globe.*

"The incidents are all in historical keeping, and are admirably told."—*Morning Chronicle.*

"The introduction of Wesley upon the scene is well managed, and his character very fairly pourtrayed. Its description of localities is admirable, adding greatly to the general effect of the narrative, and giving life and reality to the story."—*Morning Post.*

"We have amazingly enjoyed the perusal of this work. The author has made the best of very excellent materials. . . . . We anticipated a charming romance, nor were we disappointed."
Critic.

Annals of the Artists of Spain.

By WILLIAM STIRLING, Esq.

In 3 vols. demy 8vo. Price 3 Guineas, profusely illustrated with Portraits and other Engravings on Steel, Wood, and Stone.

"Of the merits of the 'Annals of the Artists of Spain,' both in design and execution, we can speak highly. Mr. Stirling's style is generally correct, always easy, and sometimes forcible. He can hit off a portrait with his pen, almost in the spirit of Velasquez with his pencil."—*Times.*

"To the artist and lover of art, Mr. Stirling will, indeed, be a pleasant companion. The arrangement of the work will suit them admirably."—*Morning Chronicle.*

"By the judicious intermixture of anecdote with disquisition and biography in the criticism, he has succeeded in keeping up and varying the interest throughout."—*Examiner.*

"We have not merely the history of the art, but of the artists—a complete view of the rise of the Spanish school, with all the surrounding circumstances that affected its formation."—*Atlas.*

"Mr. Stirling has produced one [of the most complete contributions to the literature of the fine arts which our language has possessed."—*The Rambler.*

"He has exhausted the entire Spanish school, and all that has been written on the subject by foreigners."—*Literary Gazette.*

"His pages are enriched with curiosities of literature bearing upon the manners and spirit of different epochs, larding the dry details of inferior artists now with grave history, anon with Court gossip and anecdote; thus an *olla podrida* is set before us stuffed with savouries, the national garlic not omitted, but so judiciously proportioned that our fairest reader may welcome this candidate for favour to her innermost boudoir."—*Quarterly Review.*

"We are bound to say of these splendid volumes, that they deserve a place among the most elaborate and carefully written books which have appeared in this country for many years."
Fraser's Mag.

Tactics for the Times as regards the Condition and Treatment of the Dangerous Classes.

By JELINGER C. SYMONS, Esq., B.A., Barrister-at-Law.

CONTENTS.

CHAP. I. How to treat the ailments of the People.—II. Crimes and Criminals, with statistics and coloured diagrams, exhibiting Crimes and their increase in different districts, and their relation to Population, Occupation, Drink, Age, Sex, Education, &c.—III. Penal Discipline and proposed Remedies for Crime.—IV. Pauperism and Poor Laws.—V. Educational and Industrial Farm Schools.—VI. Kind treatment and better provision for the tastes and wants of the Poor are needed.—Appendix, with copious statistics, &c.

1 vol. demy 8vo. with Coloured Diagrams, price 7s.

"A work full of striking facts and valuable suggestions."—*Edinburgh Review.*

Life for Life;

Or, "THE LAW WRITTEN IN THE HEART."

A Brief Tale for 1850.

"And now, art thou cursed from the earth, which hath opened her mouth to receive thy brother's blood from thy hand."—*Genesis.*

Dedicated to William Ewart, Esq. M.P.

Small 8vo. cloth gilt, price 3s. 6d.

"This is a very powerfully written tale, and developes great knowledge of the human heart. Its object is to shew that the divine law against murder, with its tremendous penalty, remains unrepealed, and must do so as long as the world endures. We recommend it to general perusal, as one of the most thrilling the press has for some time produced."—*Berkshire Chronicle.*

Practical Observations on Epidemic Cholera.

And its Identity with Epidemic Influenza; with brief suggestions for its treatment in every stage of Disease. By J. C. ATKINSON, Esq., M.R.C.S.

In small 8vo. price 1s.

The Principles and Practice of Surveying.

By CHARLES BOURNS, M.I.C.E.

Third Edition, demy 8vo. with Plans and Diagrams, price 15s.

"This is a truly useful book; in the second part of it we have good and sound practical instruction on engineering and other surveying. . . . We have no hesitation in saying that this work will be a complete guide in the hands of the student." . . .—*The Builder.*

"On engineering surveying there is much valuable information, which subject has hitherto been strangely neglected."—*Dublin Evening Packet.*

"His practice on field work and engineering surveying generally, is of itself a volume of instruction to the young practitioner, and, without so entering into abstruse formulæ and mathematical calculations, as to make the work puzzling, it contains all that is required to render it, not only a source of instruction, but also a most excellent work of reference." . . .—*Mining Journal.*

Eothen. Fifth Edition.

1 vol. small 8vo. price 5s., with Illustrations.
Or elegantly whole bound in morocco, price 9s.

"The best book of Eastern travel that we know."—*Examiner.*

"Graphic in delineation, animated in style, frank in manner, and artistical in the choice and treatment of subjects selected for presentation."—*Spectator.*

"The book is as 'light as light,' and lively as life, yet there are in it passages and scenes, which would make most men grave and solemn."—*Athenæum* (second notice).

"This book with a bad title is wonderfully clever."—*Examiner.*

"We have seldom, in a word, perused a volume which so irresistibly claims the attention, from the first page of the preface to the finale of the wanderings."—*Atlas.*

Hints to the Sick, the Lame, and the Lazy; or, Passages in the Life of a Hydropathist. Second Edition.

With Additions, *containing an Account of the Author's personal experience of the system pursued at* SUDBROKE PARK, upon the occasion of a recent residence at that Establishment.

By a VETERAN. With numerous Illustrations by a RECRUIT.
Fcap. 4to. price 7s 6d.

"The advice is honest and disinterested: and the manner in which it is conveyed is facetious and frolicsome. If the writer be, as he asserts, a 'veteran soldier,' he has been turned by the limpid element into the gamesomest old buck it is possible to conceive. It is an effectual cure for the moment of the blue devils."—*Morning Post.*

"This is a merry, and yet, in the main, a judicious recommendation to the 'sick, the lame, and the lazy' to seek health, activity, and the use of their limbs, by going through a course of hydropathic treatment."

The Pipe of Repose; or, Recollections of Eastern Travel.

By ROBERT FERGUSON, Esq.

Second Edition. 1 vol. small 8vo., price 5s.

"This small volume is one of the liveliest accounts of eastern travel we have read."
Morning Herald.

"This is a small volume, but we do not disparage 'Eothen' when we offer an opinion that it is Eothen in miniature, Eothen in spirit, Eothen in popular attraction, and quite Eothen in talent. It is, indeed, a charming little book."—*Literary Gazette.*

"Exceedingly entertaining."—*Sun.*

"Clever and original."—*Englishwoman's Magazine.*

Antwerp. A Journal kept There.

Including also Notices of Brussels, and of the Monastery of St. Bernard, near Westmalle. Fcap. 8vo., price 5s.

"Here is no attempt at fine writing. The writer has completely achieved his object of giving a correct impression of Gothic and palatial Antwerp. The account of Westmalle will be found peculiarly interesting."—*English Churchman.*

"A Guide by no common writer. Just enough and no more. It indicates all that is necessary for the tourist to view; and observes with excellent taste on all that is remarkable."—*Douglas Jerrold.*

"His mind is vivacious, his manner brisk and pleasant, his composition sustained by vigour and smartness."—*Spectator.*

Notes of an Irish Tour.

By LORD JOHN MANNERS, M.P.

Fcp. 8vo., cloth, 3s.

Eda Morton and her Cousins; or, School-room Days.

Second Edition. Fcap. 8vo. price 6s., or elegantly bound, price 9s.

"No man is so insignificant, as that he can be sure his example can do no harm."
Clarendon.

"A more interesting work than this cannot be placed in the hands of the young; the story is well constructed, and the incidents are such as will engage and occupy attention, whilst the moral is brought out with ability and success. As a holiday or birth-day present 'Eda Morton' may be recommended with the certainty of its affording satisfaction. The young will be both edified and amused by the story, and graver minds will not find it unworthy their attention."—*The Magnet.*

"This tale will be read with interest; the moral it conveys is a sound and salutary one."—*North British Mail.*

"It is full of quiet, family adventures; its characters are such as we can at once understand and appreciate, and its scenes are laid in that circle of virtuous private life where, although there may not be much to excite, there is everything to engage those whose feelings are alive to the common affections of home. The work is certain to be as acceptable, as it must be improving to the young. As a birthday present it has the highest recommendations."—*Oxford Herald.*

The Village School Fete;

Or, Good and Evil Influences.

By A. E. CHALLICE.

Fcap. 8vo. price 5s., bound cloth, or elegantly half-bound morocco, 7s.

"This is a simple tale beautifully told. . . . The power of good and evil influence is shewn with a truth and nature that appeals to every heart."—*Morning Post.*

Shadows of the Clouds.

By J. A. FROUDE, M.A.

Author of "The Nemesis of Faith." Small 8vo., price 5s.

"Two tales are comprised in this volume, *The Spirit's Trials*, and *The Lieutenant's Daughter*: both are written with great power and undoubted talent. . . . Mr. Froude is no common writer—his style is vivid and emphatic—he touches some of the most secret springs of the heart's passions—he enchains our sympathies."—*John Bull.*

"The work shews evidence of a vigorous and cultivated understanding. The Spirit's Trials is a tale of considerable interest. The characters are felicitously drawn."—*Morning Post.*

Chollerton. A Tale of our own Times.

1 vol. fcap. 8vo., price 6s. cloth, or half-bound morocco, 7s. 6d.

"Chollerton is a religious tale—the character natural, the style easy, and rather elegant."
Spectator.

"Nearly all the points mooted within the last year or two are very skilfully introduced, and are judiciously treated in this volume. The conversations are animated and clever—the plot is good—the interest never flags. We venture to predict that it will prove one of the most popular volumes of its species."—*English Churchman.*

"It is indeed an interesting tale; and we recommend it to our readers."—*Oxford Herald.*

"This is a very pleasing volume, fraught with noble sentiments, expressed with eloquent and glowing language."—*Cheltenham Journal.*

Faust. A Tragedy.

By J. W. VON GOETHE, with Notes, translated by CAPTAIN KNOX, Author of "The Rittmeister's Budget," "Harry Mowbray," "Day Dreams," &c.

Small 8vo., price 7s.

"We have carefully examined Captain Knox's translation, and we hesitate not to say that he has nothing to fear from comparison with his predecessors—though among these are Mr. Hayward and Dr. Anster."—*Athenæum.*

How to Stop, and when to Stop. Punctuation Reduced to a System.

By WILLIAM DAY. *Fifth Edition,* price 1s. 6d.

"Acute in parts, and useful for more advanced students; that is, for such as have acquired the principles of English grammar. Some popular writers whom we could name would do well to spend a week over this volume. In this age the most useful things are often the last to be learned."—*Athenæum.*

The Council of Four. A Game at "Definitions."

Edited by ARTHUR WALLBRIDGE, Author of "Torrington Hall."

FOURTH THOUSAND. Price 1s.

"This adds one more to the means of passing an hour or two pleasantly and profitably in the social circle. It owes its origin to the circumstance of a party having failed to play the game of *bout-rimés* satisfactorily, and who were driven in consequence to their shifts for a substitute. Mr. Wallbridge's inventive power not only rescued the party from their strait, but enabled them to escape from the beaten path to this new exercise."—*Morning Post.*

The Parish Choir; or, Church Music Book.

Vol. 1, price 9s.; vol. 2, price 7s. 6d.; and vol. 3, price 9s.;

IN AN APPROPRIATE CLOTH BINDING.

PUBLISHED BY THE SOCIETY FOR PROMOTING CHURCH MUSIC.

The Letter-press consists of plainly written *Illustrations of the Common Prayer-Book;* Hints to Clergymen desirous of forming *Choirs,* or of improving the Singing in their Churches; Plain Instructions in Chanting; Familiar Explanations of the Choral or Cathedral Service; Articles on the Spirit of Divine Worship; Lessons in Singing; in fact, Articles on any point relating to CHURCH MUSIC, or the CHURCH SERVICES. The Musical portion contains the Church Service complete, and a Choice Collection of Anthems, by Goldwin, Okeland, Haselton, Weldon, Batten, Rogers, Aldrich, &c. &c.

Meditations, upon Twenty Select Psalms of the Prophet David.

By Sir ANTHONY COPE, Knight, (Vice-Chamberlain to Queen Katherine Parr.)

Reprinted from the Original Edition of 1547. With Notes and a Biographical Preface. By WILLIAM H. COPE, M.A., Minor Canon and Librarian of St. St. Peter's, Westminster.

Post 8vo., with Illuminated Title and Ornamental Border, price 7s. 6d.

"Not only are these annotations valuable as a specimen of the devotional writing by a Layman, living in times exceedingly unfavourable for the cultivation of the meeker graces, but the writings themselves possess intrinsic value. The work is beautifully got up.—*Morning Post.*

An Exposition of the Church Catechism.

In the form of Brief Illustrative Lectures, with Questions appended.

By the Rev. JOHN BOOKER, A.M., Vicar of Killurin, Diocese of Ferns, Wexford.

12mo., price 3s. 6d.

*** The chief object of the author has been to furnish a suitable auxiliary to such clergymen as desire to give catechetical instruction in the Chuach, after the Second Lesson at Evening Prayer, as well as to provide a useful Book for Schools and the Heads of Families.

"This object is never lost sight of, and is well carried out. The author is an unambiguous writer; he does not fritter away an explanation."—*Weekly News.*

New Pamphlets.

New Forms in Architecture.

For Iron, Slate Slab, Hollow Brick Pottery, Fire and Rot-proof Timber, and other superior and economical Materials, for which the established forms of the Building Arts, are wasteful and inconvenient. Demy 8vo., price 2s.

An Enquiry into the Establishment of the Royal Academy of Arts.

To which is prefixed a Letter to the Earl of Bute, by Robert Strange, Member of the Royal Academy of Painting at Paris, of the Academies of Rome, Florence, Bologne; Professor of the Royal Academy at Parma, &c. 1775.

Edited by WILLIAM CONINGHAM. Demy 8vo., price 1s. 6d.

Abstract of the Constitution and Laws of the Royal Academy of Arts in London.

Established Dec. 10, 1768. With a Preface. By WILLIAM CONINGHAM.

Demy 8vo., price 1s. 6d.

Royal Academy of Arts in London.

Laws relating to the Schools, the Library, and the Students.

With Preface by WILLIAM CONINGHAM. Demy 8vo., price 1s.

On Sugar Cultivation in Louisiana, Cuba, &c.; and the British Possessions.

With an Examination of the Minutes of Evidence taken before the Parliamentary Select Committee, to inquire into the Condition of the Sugar and Coffee Plantations in the East and West Indies and the Mauritius.

By J. A. LEON, Esq.

To whom was awarded by the Royal Society of Arts the Large Gold Medal given by H.R.H. Prince Albert for the best Treatise on the Cultivation and Manufacture of Sugar. Demy 8vo., price 4s.

17

ACCOMMODATION FOR THE APPROACHING EXHIBITION.

HOUSES or APARTMENTS to let, in the suburbs of London. For particulars apply to MR. J. OLLIVIER, 59, Pall Mall.

A HOUSE to be let, Furnished, situated in the most pleasant and respectable part of the King's Road, Chelsea, consisting of nine Rooms—two Sitting-rooms, four Bed-rooms, two Kitchens, and Store-room—and every convenience for a small family, with Garden back and front. Attendance if required. For particulars address to A. V., care of MR. J. OLLIVIER, 59, Pall Mall.

To be let, Furnished, at Brompton, in the most agreeable part, within a quarter of an hour's walk of the Exhibition,

A TEN-ROOMED HOUSE,

Handsomely Furnished, consisting of two Drawing-rooms—Dining and Breakfast Parlour—three Bed-rooms and Dressing-room, or if required four Bed-rooms, with the usual domestic offices—The use of a fine Piano-Forte, with an excellent collection of Music and a Library of Books.—A small ornamental Garden and Conservatory. For terms apply to B. A, MR. J. OLLIVIER, 59, Pall Mall.